Indiana’s Stake in the CO$_2$ Control Debate

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March 6, 2008
Indiana Government Center
Indianapolis, Indiana

The Energy Center at Discovery Park
Purdue University
CCTR, Potter Center, 500 Central Drive
West Lafayette, IN 47907-2022
The Real Problem
We are not ready

The Energy Workforce of the Future

- All energy industries face issues
  - Coal miners are retiring; average age 51
  - Technologies are changing
  - Boilermakers are offshore
  - Nuclear welders do not exist
  - Stigma of a vocational technical education
  - Power generation industry – average age 50
    - Employs 1 million nationwide
    - ½ workforce retirement in 5-10 years
    - 62% of managers are 50 and older
    - 61% of line superintendents are 50 and older
    - 43% of foremen are 50 and older

southern states energy board
Evolution of the Coal Power Plant

Yet the electricity per ton of coal input stays level

Figure ES-1
Evolution of Coal Fired Power Plant Emissions Capture²
Price of Energy

Demand Increases even as Price Increases

From 1995 to 2006:

- Coal price per MBtu increased 21.1%
  Demand increased 14.0%

- NG price per MBtu increased 250.5%
  Demand increased 26.7%

- Petroleum price per gallon 107.5%
  Demand increased 14.9%

- Electricity in Indiana price increased 23.5%
  Demand increased 21.3%
### Estimates of Cost of Impact of CO₂ Controls

<table>
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<th>Type</th>
<th>size</th>
<th>Plant</th>
<th>CO₂</th>
<th>Water</th>
<th>Cost of Plant</th>
<th>Cost of Plant Cost</th>
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<tbody>
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<td>IGCC 630MW</td>
<td>39.53%</td>
<td>198.7</td>
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<td>IGCC 630MW</td>
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<td>PC 550MW</td>
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<td>PC 550MW</td>
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**Difference**

-18.9% -89.6% +14.9% +36.4% +35.5%

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How much water does your cell phone consume?

2.8 gallons a day if you charge it at home, 0 if you charge it with your car.
Power Production Losses Associated with CO$_2$ Capture

**Figure ES-3:** Plant Performance Impact of Retrofitting a Pulverized Coal-Fired Plant at Various Levels of Carbon Capture
Best to Worse Scenarios

Range from -$10/ton to $90/ton

1) High purity ammonia plant / nearby (<10 miles) EOR opportunity

2) High purity natural gas processing facility / moderately distant (~50 miles) EOR opportunity

3) Large, coal-fired power plant / nearby (<10 miles) ECBM opportunity $20/ton

4) High purity hydrogen production facility / nearby (<25 miles) depleted gas field

5) Large, coal-fired power plant / nearby (<25 miles) deep saline formation $45/ton

Source: Global Energy Technology Strategy Program, Battelle & PNNL, May 2007
Best to Worse Scenarios (continued)

6) Coal-fired power plant / moderately distant (<50 miles) depleted gas field
7) Iron & steel plant / nearby (<10 miles) deep saline formation
8) Smaller coal-fired power plant / nearby (<25 miles) deep saline basalt formation
9) Cement plant / distant (>50 miles) deep saline formation
10) Gas-fired power plant / distant (>50 miles) deep saline formation

Source: Global Energy Technology Strategy Program, Battelle & PNNL, May 2007
Midwest CO$_2$ Capture Potential

Midwest IGCC Power Plants

**Wabash** 262MW
ConocoPhillips E-Gas

**Edwardsport** 630MW
GE Gasification Technology

**Taylorville** 630 MW
GE Gasification Technology

1 Wabash
2 Edwardsport
3 Taylorville
What Can Indiana Do NOW? Wabash

• **Started in 1994**, it was the most visited DOE research site outside of national labs for > 10 yrs.
• The **longest continuously operating coal and pet coke gasifier** in the US.
• Now it is a full gasification production site supplying syngas to Duke’s Wabash River power station using pet coke as a fuel source.
• CCTR and Purdue University want to put 1 or 2 graduate engineering students at the Wabash site for the purpose of determining the training and education needs of future gasifier workers.
• **This facility is ready today to work on CO₂ capture**, it is already built & functioning, & designed for research activity.
• **The best short term site for CCS testing.**
The only IGCC that has both air permits & regulatory authority to be built.
Edwardsport has a market in place for its electrical production adding to the Duke Indiana capacity, a capacity that is sorely in need of new generation.

- The IURC ordered Duke to perform a study of how to reduce CO₂ emissions by 20%.
- The study of how to add a CO₂ system onto an existing IGCC is very important. Other future IGCC facilities will use Edwardsport as a model not only of how to build an IGCC, but also how to accommodate CO₂ capture.
This CCTR sponsored project started as a proposal to put a small scale IGCC inside Crane Military base to make it energy self sufficient.

- **Early studies** indicates that this is not practical:
  - but a 25 MW system could supply Crane with its power needs,
  - maintain enough excess gas to supply a fertilizer plant or,
  - produce FT fuels for military use
  - if the facility is moved a few miles off base.

(closer to a water source).

- The **key to the system** will be the capture of CO$_2$ for sale to industry. At this size facility CO$_2$ could be captured is technologically viable.

- This would prove to be a **very good test case** for how to scale up CO$_2$ technology.
Indiana Gasification Inc.:

- This **large scale coal gasifier** will convert coal to usable natural gas for distribution through the existing gas pipeline system.
- The **location of this facility would also make it ideal** as a source of CO₂ for the proposed CO₂ pipeline that Indiana Illinois & Ohio have discussed.
- The gasification plant will be sized similar to that of an IGCC, but will have the flexibility of being able to move its gas production to where the market needs it.
- It also will be a perfect test case for large scale CO₂ technology development, In that the testing will not interfere with the gas production.